Results from the SOFIA/ANDES TwinMUSIC

B. Voss for the SOFIA / ANDES-collaboration

GSI, Darmstadt, Germany.

Experimental aim, Setup

After commissioning of the detectors in parasitic test beam times in 2011/2012 physics runs addressing questions from both, SOFIA [1] and ANDES [2] were performed in August / September 2012 at CaveC / ALADIN@GSI.

An overview of the experimental setup and conditions leading to the production of the secondary beams is given in [3-6] together with the design of the TwinMUSIC detector employed to determine the nuclear charges and positions of fission fragments produced by coulomb excitation.

Results

Secondary and primary beams of various actinides ^{200}Ra, ^{202}Rn, ^{209}Ra, ^{217}Ac, ^{222}Th, ^{226}Th, ^{230}Th, ^{236}U, ^{238}U, ^{238}Np with energies of 700 AMeV to 950 AMeV and primary rates of several 10^5 particles/second over spill durations of 5s -10s were impinging on a set of foils of 2x 600 µm thick depleted Uranium (0.2% enrichment, 11.50 mg/cm^2) plus 1x 125 µm thick Lead (1.413 mg/cm^2) in the active target.

A charge-separation power of $\Delta Z/Z \approx 1.5\%$ - 2.4% for the TwinMUSIC has been achieved for (fission) fragments in the range of {30,60}. The respective spectra are shown in Fig. 1 and 2.

At the same time a spatial resolution of 60-80µm (FWHM) for single anodes was obtained from the drift in horizontal direction for the detector gases P25 and Ne/CO_2/CF_4/N_2 in use. This value is only slightly varying with the anode positions in in-beam direction.

Outlook

The still ongoing analysis is aiming for a refinement of the results obtained. Nevertheless already now it can be stated that the current concept of the SOFIA TwinMUSIC system will serve as a frame of reference for the R&D towards a modern energy-loss measurement device for the Super-FRS@FAIR. Here a detector system is required to work in transmission mode with an as low as possible material budget with respect to its active volume, providing excellent energy and spatial resolution for particles ranging from Protons up to Uranium impinging with high-rates of up to 10 MHz.

A compact detector setup and dedicated readout electronics coping with these needs are currently under development.

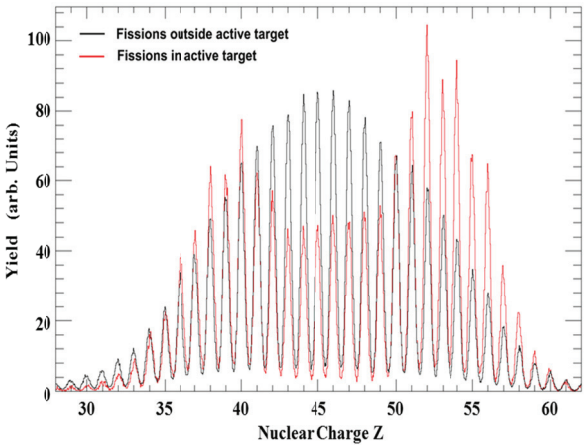

Figure 1: Charge distribution for light fragments emerging from fission inside (red) and outside (black) the active target as determined by the TwinMUSIC.

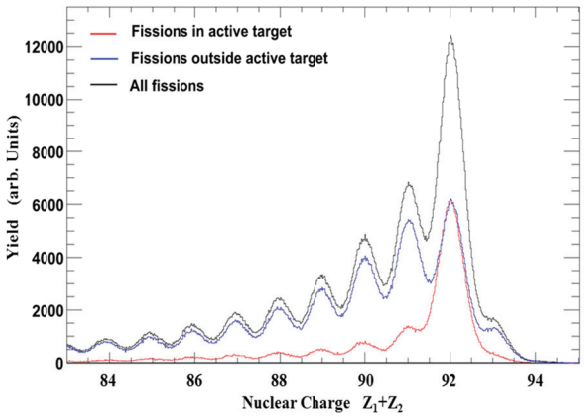

Figure 2: Charge distribution for the sum of fragments emerging from fission inside (red) and outside (black) the active target as determined by the TwinMUSIC.

References

[1] J. Taieb et al., Int. J. Mod. Phys. E 18 (2009) 767-772.
[2] http://www.andes-nd.eu
[3] K.-H. Schmidt et al., NPA 665 (2000) 221.
[4] B. Voss et al., GSI Scientific Report 2010, GSI Report 2011-1, 2011, p.223.
[5] B. Voss et al., Proceedings of the IEEE Nuclear Science Symposium, Medical Imaging Conference 2011, 2011, Valencia, Spain
[6] B. Voss et al., GSI Scientific Report 2011, GSI Report 2012-1, 2012, p.184-186.